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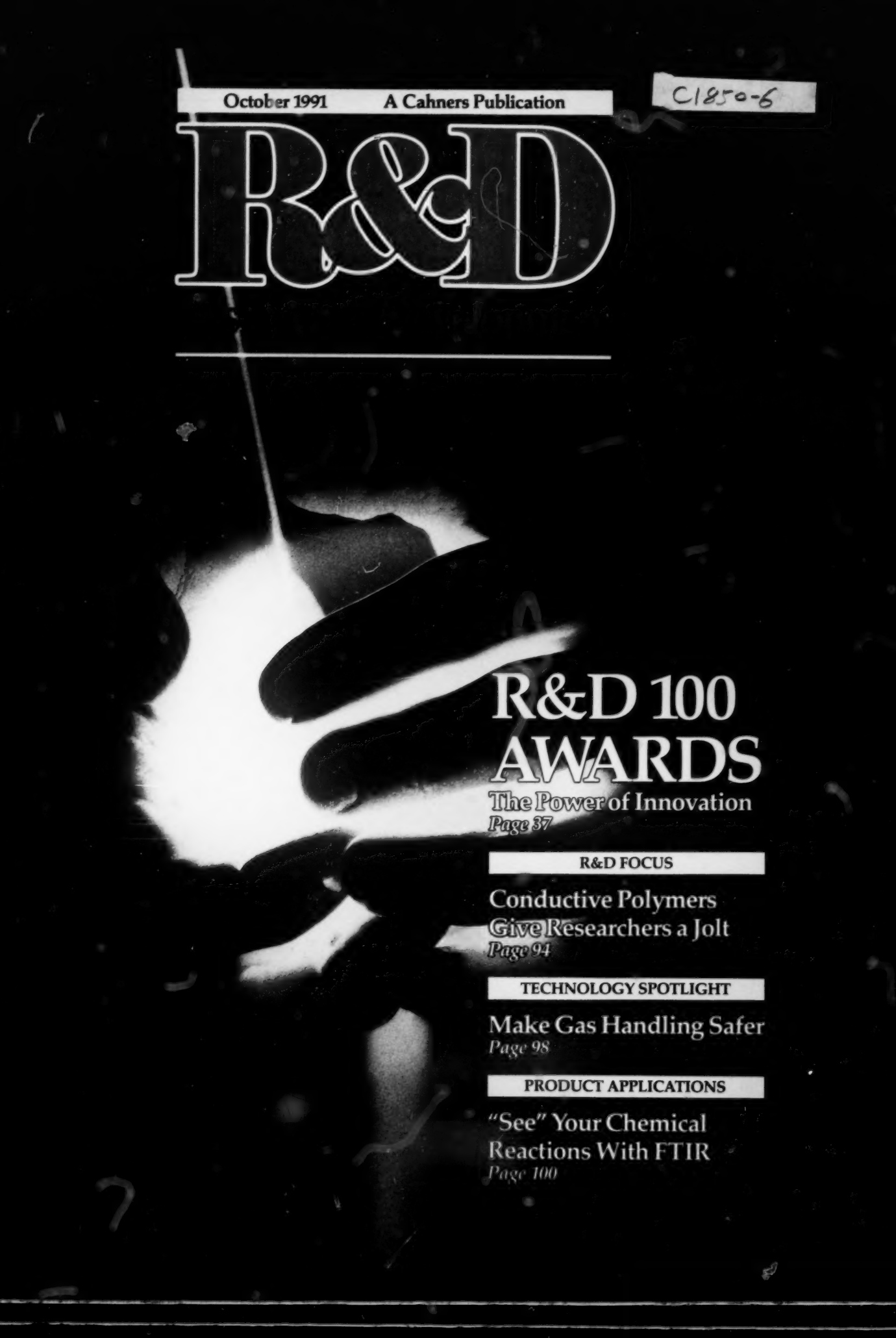

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R&D

The International Magazine of Research and Development

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ABOUT THE COVER This year's R&D 100 Award winners exemplify the power of innovation, as does the photo from *Arthur D. Little Inc.* See page 37.

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Conductive Polymers Give Researchers a Big Jolt 94

Research into electroactive polymers is showing that these materials may have a wide variety of niche market applications.

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R&D BUSINESS

Instrument Needs for Academics Revealed

More researchers in academic institutions buy new analytical instruments to study emerging technologies than to replace obsolete or nonfunctional equipment, according to a recent U.S. National Science Foundation (NSF) study.

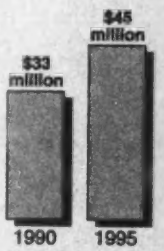
For all of the science and engineering fields surveyed, 58% of the purchased instruments were needed for experiments that could not be performed with existing equipment. Replacement needs accounted for 17% of the instrument purchases, and expansion of existing capabilities accounted for the remaining 25%.

More than $800 million in equipment purchases were made during the 1988 to 1989 academic year. After adjusting for inflation, this is an 11% increase over purchases in 1985 to 1986. Average instrument prices during this period rose slightly, except for some types of bioanalytical equipment which had substantial increases.

An NSF study for the 1983 to 1984 school year reported that 72% of academic department heads said that their faculty researchers could not perform critical experiments because they lacked the necessary equipment. The current 1989 to 1990 survey asked the same question and found that, while still relatively high, this limitation had been reduced to 62%.

For a copy of this free report *Academic Research Equipment and Equipment Needs in Selected Science and Engineering Fields: 1989-1990* (NSF 91-311), call 202/357-7492. □

Particle Analyzers Lead the Pack



Sales of particle size analyzers used in analytical laboratories are expected to grow 6.4% annually over the next five years to $45 million in 1995, according to Strategic Directions Intl., a Los Angeles-based management consulting firm.

These sales will outpace those of other physical property measurement instruments, such as surface area analyzers, zeta potential analyzers, and porosimeters.

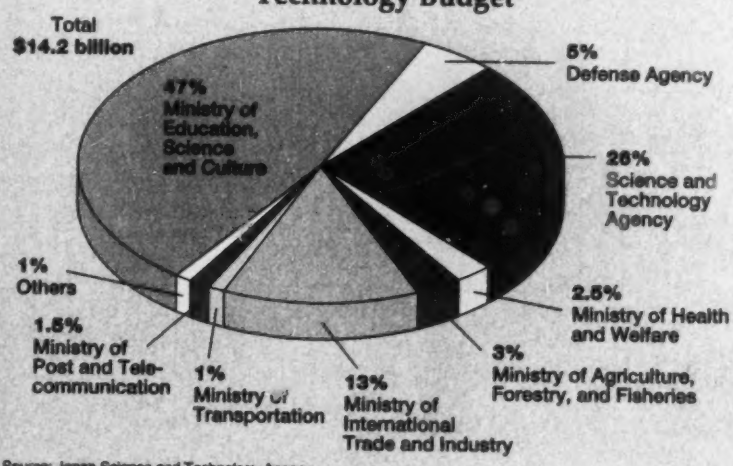
Japan Continues Its Heavy R&D Investment

No matter which sector of the Japanese community you look at, you will find continued evidence of recent increases in its R&D spending. A survey by Japan's National Institute of Science and Technology Policy reveals that R&D expenditures by Japan's top 10 companies in sales in FY89 were 8.3% larger than even their spending on manufacturing plants and equipment.

Another survey of 16,200 businesses, universities, and private institutions by Japan's Management and Coordination Agency reveals that total R&D expenditures rose 11.2% in FY89. U.S. R&D in FY89 rose only 5%, according to the U.S. National Science Foundation. Japan's Science and Technology Agency also increased its budget 6% in FY90 with large increases to nuclear energy facilities.

Estimates of current trends indicate that U.S. and Japan R&D spending increases may be changing (see *R&D* August 1991 Business). □

How Japan Distributes Its Science & Technology Budget



***Japan's science and technology budget** promotes R&D in nuclear energy and safety, space development, earth and ocean sciences, materials, and life sciences.*

Stay Competitive By Integrating R&D

Concurrent engineering (CE) is the latest buzzword for integrating a company's overall resources to produce new products faster, with higher quality, and at a lower cost. It's really a combination of many new manufacturing concepts, such as just-in-time scheduling, total quality management, and design-for-manufacture concepts.

"A 10% evolutionary improvement in your manufacturing response time is no longer adequate to be competitive," says Sammy Shina, associate professor of engineering at the Univ. of Lowell, MA. "Companies that use the combined capabilities of CE are able to implement improvements by significant orders of magnitude."

Late delivery of a new product, for example, often is the biggest cause for loss in a company's profits, according

to Shina. "The iterative nature of conventional product development cycles is mostly to blame for these late deliveries," he says. "The most important result of applying CE is the shortening of a product's concept, design, and development process by changing it from a serial process to a parallel one."

Shina is author of *Concurrent Engineering and Design for Manufacture of Electronic Products*, published by Van Nostrand Reinhold. □

Equipment Sourcing Follows Production

As semiconductor component production shifted from U.S.-based companies to Asian companies over the past five years, so did the sourcing of equipment to manufacture these products, according to a recent survey by VLSI Research Inc., San Jose, CA.

The market for semiconductor manufacturing equipment grew by 80% during this period, from $5.1 billion in 1985 to $9.3 billion in 1990.

In 1985, seven of the top 10 semiconductor equipment manufacturers were U.S.-based companies and only two were Japanese. In 1990, the leader board had changed with Japanese-based Tokyo Electron Ltd., Nikon, Advantest, Canon, and Hitachi dominating the top spots.

Only Santa Clara, CA-based Applied Materials has increased its share and moved from the tenth spot in 1985 to the third in 1990. □

1990's Top 10 IC Equipment Firms

		Sales (millions)
1	Tokyo Electron (Japan)	$706
2	Nikon (Japan)	692
3	Applied Materials (U.S.)	572
4	Advantest (Japan)	423
5	Canon (Japan)	421
6	Hitachi (Japan)	304
7	General Signal (U.S.)	286
8	Varian (U.S.)	285
9	Teradyne (U.S.)	218
10	SVG (U.S.)	204

Source: VLSI Research Inc.

Japanese firms dominate a list of the top semiconductors equipment makers.

Is East Europe A Research Bargain?

Since the end of the cold war, East European countries have received a lot of scrutiny in an effort to commercialize their untapped technological capabilities.

Czechoslovakia, Hungary, and Poland are considered to be the strongest contenders for technical ventures, according to Ernest Gilmont, a senior consultant at Arthur D. Little Inc., Cambridge, MA. "Few Westerners realize what a strong work ethic and engineering skill base Czechoslovakia has," says Gilmont.

However, Hungary still is the most attractive partner for Western companies, because it started the partnering process several years ago.

While East European countries have a lower standard of living than that of Western countries, their technologies often are similar, says Gilmont.

"This window of opportunity may not be open for long," says Gordon Feller, a staff member at the International Technology Institute, Pittsburgh. "As Eastern researchers secure intellectual property rights over their work, they will become tougher business partners." R&D

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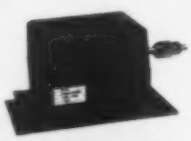
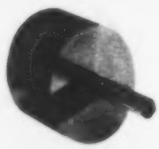
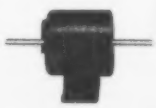


Transfer Standards (Absolute & Differential)

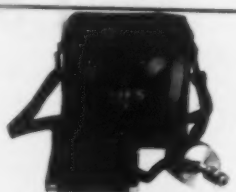
Heated & High Accuracy Sensors



General Purpose OEM Transducers



Differential OEM Type Transducers



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CIRCULATION

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